Backgrounder

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Center for Immigration Studies

Alternatives to Immigrant Labor?

Raisin Industry Tests New Harvesting Technology

By Bert Mason, R. Keith Striegler, and Gregory T. Berg

"The (fruit) crop of the present year, although deemed a short one, taxed the labor capacity of the State to the utmost to fit and prepare it for shipment to the world's market. If such was the situation this year, what will it be when the numerous young orchards now just coming into bearing will be producing full crops? The labor is not now in the country to handle such an increase in production. Will the demand for labor to meet and handle this increase of production be responded to when made? If so, where from?"

"Immigration reform must be accompanied by a workable program for securing legal alien labor on a temporary basis for peak seasonal needs if and when it is needed....There are not sufficient U.S. workers who can and will become migrant farm workers to fill seasonal agricultural needs. Without an adequate supply of workers to fill seasonal labor intensive tasks such as harvesting, U.S. growers will become uncompetitive, and be forced to reduce production of labor intensive crops."

More than one hundred years separates these quotes. The former, from an editorial in the *Pacific Rural Press*, was written in 1883 and voiced California agriculture's concern about impending labor shortages that would result from the Chinese Exclusion Act of 1882 (Fuller, 1991). The latter, issued by the California Farm Bureau Federation, promoted a temporary guest worker program as an amendment to immigration legislation pending before Congress in 1995. Only the style of prose popular at the time differs; the call for additional immigrant workers has been the consistent choice for California's labor-intensive agriculture since its early development in the 1850s.

There are approximately 250 crops and commodities raised commercially in California's central San Joaquin Valley. The raisin industry represents one of the most labor-intensive crops grown in the region. In order to harvest this crop, the 5,500 raisin growers employ 40,000 to 50,000 workers for a three- or four-week harvest period. Typically, the grapes (dominantly Thompson Seedless variety) are cut with a knife, placed into a pan, and then laid onto a paper tray for drying. During the two- to three-week drying process, the trays must be manually turned, then rolled and collected (Striegler, Berg, and Morris, 1996).

Harvest workers are paid on a piece-rate basis, which averaged $0.15-0.17 per tray in 1991 (Alvarado, Mason and Riley, 1992). Workers reported average earnings of $6.25 per hour in that year. In addition to the harvest tasks, substantial pruning is also required each year. Mamer and Wilkie (1990) estimate that between 80 and 100 hours of labor per acre is required to produce raisin grapes using conventional technologies; labor costs obviously represent an important component of the cost of producing raisins.

Beyond cost concerns, raisin growers also face uncertainties about the supply of labor. In our 1991 survey of farm workers employed in the raisin harvest, fully 94 percent of the workers were born outside the

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United States (primarily Mexico). At that time, 35percent of the workers interviewed readily admitted that they had used fraudulent documents to obtain employment (Alvarado, Mason and Riley, 1992). In the ensuing five years, it is likely that the proportion of the workforce who are in the United States illegally has increased beyond the 50 percent mark. While support of a legal, temporary guest worker program remains the top choice for the industry, attention is turning to alternative methods to prune and harvest raisin grapes.

Dried-on-Vine Interest Increases

The traditional method of producing raisins from Thompson Seedless grapes requires a substantial amount of seasonal labor. Over the years, several methods have been developed which would mechanize at least a portion of the raisin production process. Recently, the industry has become interested in labor-saving production systems such as dried-on-the-vine (DOV) cultural practices.

DOV raisin production research began in Australia in the late 1950s and early 1960s (May and Kerridge, 1967). The most significant development of this early research was the use of harvest pruning, or cutting the fruiting canes upon fruit maturity. Due to Australia's climatic conditions and market preferences, the methods of raisin production (DOV or conventional) use oleate sprays or dipping emulsions to accelerate drying and reduce browning. Problems with inadequate emulsion spray coverage, unfavorable drying conditions, and product quality have hindered adoption of the early DOV practices.

In recent years, new trellis systems have been developed for DOV production in Australia. The Irymple system, which is described in detail by Gould and Whiting (1987), the Shaw system (Shaw, 1986), and the swing-arm system (Clingeleffer and May, 1981) are examples. These trellis systems follow the general principle of separating the vine canopy into fruiting and non-fruiting zones. These systems were developed to facilitate mechanization of harvest pruning.

Innovations and improvements to DOV production systems continue to evolve both in Australia and the United States. Shaw is currently working on the design and improvement of his system in Australia. His latest version uses a swinging cross-arm system which separates fruiting and renewal zones and allows for the mechanization of cane severing and harvest (Shaw, Hayes, Bucik, Clingeleffer, and Skinner, 1996).

Sun-Maid Growers, Inc., of California has developed and patented a DOV raisin production system. This systems involves a specially-designed trellis which can be easily adapted to existing vineyards. The Sun-Maid trellis system separates the vine canopy into distinct fruiting and renewal zones, which facilitates harvest cane severing and promotes a good environment for the growth of renewal canes. The fruiting zone, which later becomes the drying zone, is oriented toward the south side in east-west directional rows. This orientation is designed to enhance the drying rate, thereby making it possible to dry Thompson Seedless grapes on the vine without oils or other aids in most seasons. Several companies are also involved in designing necessary machinery, such as cane severing units, leaf blowers/removers, and harvesters.

One grower in the Madera area, Lee Simpson of Simpson Vineyards, has completely redesigned his vineyard system from the ground up for DOV production. He has developed a total systems approach, which involves selection of cultivar, training systems, planting density, irrigation methods, and mechanization. In 1992, 160 acres of Fiesta vines were planted in a high-density manner (1,089 vines per acre, about twice the normal planting density). An overhead trellis system (known as a pergola) is used and the vines are head trained and cane pruned. Fruiting and renewal zones are placed in alternating row middles from year to year. Canes are severed by hand and the raisins are allowed to dry naturally. Tractor-mounted harvesters are used to gently knock the raisins off into bins at harvest time. Simpson Vineyards keeps a small crew of employees (5-6) working year round performing vine training, irrigation, trellis and equipment repair, and pest management. A small crew of contract labor is hired at the time of cane severing to assist the permanent crew. During the 1996 season, 13 extra workers were hired and it took only 3 days to complete the harvest cane severing.

The Thompson Seedless variety, which comprises more than 90 percent of raisin production, can be difficult to dry on the vine under some conditions. USDA researchers have recently developed a new variety, DOVine, that responds well to vine drying. DOVine is an early season white seedless grape that matures sooner than Thompson Seedless and has other characteristics that are favorable for DOV production systems.

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Economics of DOV

DOV has at least three potential economic advantages when compared to traditional production systems (*Ag Alert*, December 1995).First, mechanical pruning and harvesting will substantially reduce the costs and uncertainties associated with hand pruning and harvesting. Simpson claims that he can harvest his 160 acres with only six to eight employees; conventional practices would require crews of 20 to 40 workers to pick the raisin grapes.

A second potential advantage of DOV production techniques is that the grapes dry on the vine rather than on the ground. This makes the raisins much less susceptible to rain damage, which is always a concern for raisin growers. In some years, heavy rains during the drying period have significantly damaged the crop. Grapes drying on the vine can apparently withstand substantial rainfall without damage. One potential drawback of DOV is that it normally takes six to seven weeks after the canes are severed for the grapes to dry completely. This means that the drying grapes are exposed to inclement weather for a longer period of time, although they are likely to withstand rain better than grapes drying on the ground.

Finally, the dense plantings allowed by the new trellis systems will increase yields significantly. Simpson expects that his vineyard will produce 5 to 6 tons per acre when the vines reach maturity; conventional raisin vineyards average 2 to 2.5 tons per acre.

The economic benefits of DOV require substantial upfront investment by the grower. The Simpson vineyard cost $4,500 per acre (exclusive of land costs) for planting, trellising, ground preparation and installation of subsurface drip irrigation five years ago. This is approximately $2,500 per acre more than conventional planting would cost. But the key to economic feasibility for Simpson's approach is that he will produce more than twice the yield per acre than conventional production systems. For the 1996 crop year, the Simpson vineyard produced 4.46 tons per acre, compared to a county average of less than 2 tons per acre. Expectations are that as the vineyard matures and cultural practices are refined, yields on the Simpson vineyard will increase to 5 to 6 tons per acre.

Raisin returns have averaged about $1,000 per ton (weighted average for free and reserve tonnage) in the past two years. Gross revenues will therefore be about $3,000 per acre higher for the Simpson vineyard than a conventional planting. This increased revenue should allow the higher initial capital costs to be repaid fairly quickly.

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According to Simpson's production records, total labor hours per ton of production in 1996 were approximately 45 hours per ton. This is similar to that required in conventional practices. The key difference is that the labor is smoothed over the entire year rather than being concentrated into two short peaks for pruning and harvesting. Simpson employs five permanent year-round workers. He hired five extra workers to help prune the vines, 13 temporary workers to cut the canes, and only three temporary workers to assist during harvest.

The 1996 harvest took about 13 days to complete. Harvest costs were about $28 per ton, compared to $220 per ton using hand labor. Simpson uses two harvest machines attached to tractors that are used for other farm activities throughout the year. Each harvest machine costs about $20,000. For smaller operations, a custom harvester arrangement might be economically advantageous.

Simpson also notes two other economic advantages of his trellis system. First, the quality of his raisins is high because they never touch the ground. This reduces problems with dirt, sand and mold. Secondly, he does not have to purchase rain insurance, which costs about $80 to $100 per acre. DOV growers are probably less at risk if there is light or moderate rainfall, but it is not known at this time how DOV raisins will survive truly heavy rains. Modified insurance that covers artificial drying or reconditioning costs might cover some of these risks for DOV growers.

The production system developed by Simpson Vineyards is feasible only for new vineyard plantings. Other DOV systems are being developed that are appropriate for retrofitting existing vineyards. As mentioned earlier, Sun-Maid Growers of California has developed and is testing a patented system of canopy separation and south side drying that can be used on established Thompson Seedless vineyards (*Grape Grower*, November 1995). Conversion costs are estimated to be in the range of $1,200 to $1,500 per acre, and include stakes, posts and wires plus labor to install the new trellises. The Sun-Maid trellising system is designed to allow the canes to be cut and the raisins harvested by machines. Sun-Maid has arranged harvesting services with two companies, and will contract with growers to provide custom harvest

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services. Preliminary estimates by Sun-Maid predict that growers will save about $200 to $300 per acre in labor costs. This makes the payback period for conversion fairly lengthy, although the return on investment would be attractive. One grower using the Sun-Maid system predicts that he will eventually be able to maintain current production levels while reducing labor costs by 80 percent (Goble, 1994).

Conclusion

Since its inception, the raisin industry has depended largely on foreign-born workers to harvest the crop. Currently, over 90 percent of the harvest workforce are immigrants, and it is likely that over half are illegally in the United States. In 1991, only 28 percent of raisin growers who responded to a survey indicated that they would consider shifting to a mechanized harvest system in the event of a labor shortage (Alvarado, Mason and Riley, 1992). Since that time, it appears that attitudes have changed. These DOV systems appear technically and economically feasible, and hold promise for reducing the need for legal and illegal seasonal labor. One grower who has shifted to DOV enthusiastically endorses the system: "[DOV] can reduce labor, reduce weather hazards, reduce environmental concerns of dust and chemical use…DOV is so good it's scary." (Goble, 1994).

As with any new technology, early adopters will be watched carefully by the rest of the industry. One obvious barrier to adoption of DOV production systems is the continued availability of cheap and abundant labor supplies from Mexico. The raisin industry is also dominated by small growers, with an average farm size of under 50 acres. The majority of growers do not rely solely on their farms for family income; a high percentage hold full-time jobs off the farm. The average age of a raisin grower is 63 years (*Sun-Maid*, 1991). This industry structure and the demographics or ownership suggest that widespread adoption of DOV systems will occur slowly in the absence of severe labor shortages. As one longtime grower stated, "It [DOV] is the wave of the future, but it's come too late for me." (*Grape Grower*, October 1995).

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